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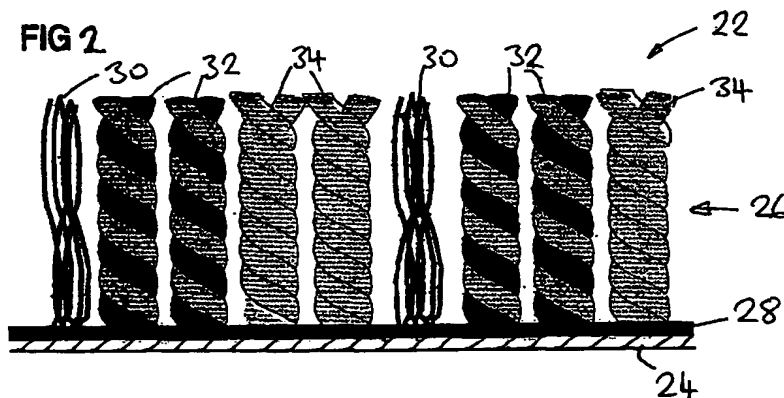
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(54) Mat

(57) A dust control mat has a fibre layer (22) including a substrate (28) and a tufted layer (26), and a rubber backing (24). The tufted layer (26) includes tufts of a synthetic monofilament yarn (30), a high twist nylon

yarn (32) and a cotton blend yarn (34) having good moisture absorbing characteristics.



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## Description

[0001] This invention relates to dust control mats and in particular, but not exclusively, to washable dust control mats, in which a rubber backing sheet is cured and heat-bonded under pressure to the back of a fabric layer. It also relates to a process for manufacturing dust control mats.

[0002] The term "washable" means washable by immersion and agitation in water or other cleaning fluid usually followed by spin extraction and tumble drying. The term "mat" is used hereinafter in a wide sense to include rugs and carpets.

[0003] Manufacturers of washable rubber backed dust control mats sell their mats to the textile rental industry who then rent or sell the mats to the end users such as shops, factories, hospitals etc. The mats are placed at the entrances of buildings and serve to remove dirt and moisture from the feet of pedestrians entering the buildings. On a weekly, two weekly or monthly cycle the dirty mats are collected and returned to the laundry for washing and replaced with clean mats.

[0004] It is normal for a laundry to purchase a number of types of mats to deal with the variety of soiling types and end users. The common types of mat are as follows:

A. Cotton Mats: In general, these are mats of low aesthetic appeal but with very good moisture, grease and oil absorbing properties. The mats have low particulate soil absorption properties as the dense closed structure of the pile only allows the dirt to remain on the surface. This type of mat is usually seen in industrial locations and in entrances other than the main high profile entrances of shops, offices, factories etc.

B. High Twist Nylon Mats: These mats utilise a high twist nylon pile and are harder wearing and generally more aesthetically pleasing than cotton pile mats. The mats are therefore usually placed at the high profile entrances to premises and can be colour co-ordinated with the decoration and may have a message or advertisement written on them. The mats have very good particulate soiling absorption properties and maintain their appearance longer than other mat types, as the soiling is absorbed into and hidden within the pile. These mats only have limited moisture and oil absorption properties.

C. Scraper Mats: These mats have a pile that is manufactured from 100% nylon or polyester monofilament, or a combination of monofilament and high twist nylon pile. This type of mat can be placed outside the entrance to enable people entering the building to wipe their feet to remove particulate soiling. The mats have little or no moisture absorbing properties and are usually complemented by a second mat of cotton or High Twist Nylon immediately inside the entrance to remove moisture from pedestrians' shoes.

trians' shoes.

[0005] It is an object of the invention to provide a dust control mat that mitigates at least some of the disadvantages of the aforesaid mat types.

[0006] According to a first aspect of the present invention there is provided a dust control mat having a tufted fibre layer including a substrate and tufts of a plurality of yarns, including a twisted synthetic yarn, a synthetic monofilament yarn and a yarn that has good moisture absorbing characteristics.

[0007] The inclusion in the tufted fibre layer of a synthetic monofilament yarn gives the mat good dirt removing properties, while the inclusion of a yarn having good moisture absorbing characteristics allows the mat to absorb water efficiently. The twisted synthetic yarn gives the mat good particulate soil absorption and a smart and durable appearance.

[0008] Advantageously, the twisted synthetic yarn is a high twist nylon yarn, preferably a two ply twisted and heat set yarn, preferably a yarn of solution-dyed Nylon 6. Advantageously, the count of the twisted synthetic yarn is in the range 1000 to 5000 decitex, and is preferably approximately 1300 decitex.

[0009] Advantageously, the synthetic monofilament yarn is a single ply twisted and heat set yarn of multiple nylon, polyester or polypropylene monofilaments. Advantageously, the count of the individual monofilaments is in the range 8 to 5700 decitex, and is preferably approximately 420 decitex, which is equivalent to a diameter of approximately 0.2mm. The total count of the synthetic monofilament yarn is preferably in the range 1680 to 6720 decitex, and in a yarn comprising eight strands of 420 decitex monofilament is 3360 decitex. The monofilaments provide a scraping effect that removes dirt very efficiently from pedestrians' shoes. They also cause an audible scraping sound when the mat is stepped upon, which encourages people to wipe their feet.

[0010] Advantageously, the moisture absorbing yarn is a cotton or cotton blend yarn, and may be a blend of cotton and rayon, a blend of cotton and polyester or a blend of cotton and polypropylene, or any other suitable blend of cotton and synthetic fibres.

[0011] Advantageously, the moisture absorbing yarn is a six fold yarn of cotton yarn of cotton count 20 to cotton count 3, preferably cotton count 7.5.

[0012] Advantageously, the ratio of twisted synthetic yarn tufts to synthetic monofilament yarn tufts in the fibre layer is in the range 2:1 to 6:1, preferably 2:1, wherein the ratio of moisture absorbing yarn tufts to synthetic monofilament yarn tufts in the fibre layer is in the range 2:1 to 6:1, preferably 3:1.

[0013] According to a second aspect of the present invention there is provided a dust control mat having a tufted fibre layer including a substrate and tufts of a first yarn and a second yarn, wherein the first yarn is a twisted synthetic yarn and the second yarn is a twisted

yarn that includes a synthetic monofilament and a third yarn having good moisture absorbing characteristics.

[0014] The inclusion in the second yarn of a synthetic monofilament and a third yarn having good moisture absorbing characteristics gives the mat good dirt removing and moisture absorbing properties, while first yarn of twisted synthetic yarn gives the mat good particulate soil absorption and a smart and durable appearance. Twisting the synthetic monofilament and the third yarn together gives the second yarn a similar stiffness to that of the first yarn, which gives the mat a uniform appearance and improves its durability.

[0015] Advantageously, the first yarn is a high twist nylon yarn and preferably a two ply yarn, the count of the first yarn being in the range 1000 to 5000 decitex, preferably approximately 1300 decitex. High twist nylon yarn has been found to give the mat very good particulate soil absorption and a smart appearance.

[0016] Advantageously, the second yarn includes a nylon or polyester monofilament of diameter 0.025mm to 0.5mm, preferably approximately 0.2mm. The monofilaments provide a scraping effect that removes dirt very efficiently from pedestrians' shoes. They also cause an audible scraping sound when the mat is stepped upon, which encourages people to wipe their feet.

[0017] Advantageously, the third yarn includes from one to six plies, preferably two plies, of cotton yarn of cotton count 10 to cotton count 1, preferably cotton count 2. The cotton yarn gives the mat very good moisture absorbing properties.

[0018] The third yarn may include a blend of cotton and polyester and the second yarn may be a twisted, heat set yarn. The inclusion of low melting point polyester allows the second yarn to be twisted and heat set. Alternatively, the second yarn may be heat set by partially melting the synthetic monofilament. Heat setting the second yarn gives it better abrasion resistance and improves adhesion between the third yarn and the monofilament.

[0019] Advantageously, the ratio of first yarn tufts to second yarn tufts in the fibre layer is in the range 1:1 to 6:1, preferably 3:1. These ratios have been found to give a good balance of properties: i.e., a good scraping effect, good moisture absorption, good particulate soil absorption and good appearance and durability.

[0020] Advantageously, the substrate includes a layer of non-woven polyester.

[0021] Advantageously, the tufted fibre layer is bonded to a rubber backing layer of natural or synthetic rubber.

[0022] The mat is preferably a washable dust control mat.

[0023] According to a third aspect of the invention there is provided a washable dust control mat having a tufted fibre layer including tufts of a plurality of yarns and a substrate of non-woven polyester, and a rubber backing layer to which the tufted fibre layer is bonded, the plurality of yarns including a high twist, twisted and heat

set synthetic yarn, a twisted and heat set yarn of multiple synthetic monofilaments, and a cotton or cotton blend yarn that has good moisture absorbing characteristics.

[0024] According to a further aspect of the invention there is provided a process for manufacturing dust control mats, in which a plurality of yarns are tufted onto a substrate to produce a tufted fibre layer having tufts of said yarns, wherein said plurality of yarns include a twisted synthetic yarn, a synthetic monofilament yarn and a yarn that has good moisture absorbing characteristics.

[0025] According to another aspect of the invention there is provided a process for manufacturing dust control mats, in which a first yarn and a second yarn are tufted onto a substrate to produce a tufted fibre layer having tufts of said first and second yarns, wherein the first yarn is a twisted synthetic yarn and the second yarn is a twisted yarn that includes a synthetic monofilament and a third yarn having good moisture absorbing characteristics.

[0026] Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a side cross-section through a portion of a dust control mat according to a first embodiment of the invention, and

Fig. 2 is a side cross-section through a portion of a dust control mat according to a second embodiment of the invention.

[0027] The mat shown in Fig. 1 has a fabric layer 2 and a rubber backing 4. The fabric layer 2 includes a tufted pile 6, which is tufted onto a substrate 8 (or primary backing), for example of woven or non-woven polyester or polypropylene of density between 70 and 300 gms/m<sup>2</sup>. In the preferred example we use a non-woven polyester substrate of density 100 gms/m<sup>2</sup>. The tufted pile can be cut, looped or both, and typically consists of cut pile. The fabric layer 2 is bonded to the backing 4 of nitrile rubber in a heated press, for example at a temperature of 170°C and a pressure of 30 pounds per square inch, applied for a cycle time of six minutes.

[0028] The pile is made up of two yarn types, these being:

A: a first yarn 10 of high twist nylon, and

B: a second yarn 12, including a nylon monofilament 14 and two cotton plies 16.

[0029] The fibre layer 2 is produced by creeling the tufting machine as follows:

A A A B A A A B A A A B etc.,

where A = high twist nylon yarn 10 and B = 3 ply cotton/nylon monofilament 12.

[0030] This produces a 1 in 4 tufted pile with three tufts of high twist nylon yarn 10 for each tuft of 3 ply cotton/nylon monofilament yarn 12 (i.e. a ratio of 3:1).

[0031] By combining the three pile types, it is possible to create a mat with the following properties:

1. increased scraping effect compared to a cotton or high twist nylon pile,
2. increased moisture absorption compared to a high twist nylon or scraper mat,
3. increased particulate soil absorption compared to a cotton mat.

[0032] In this example, the high twist nylon yarn 10 is a two ply yarn of 1300 Decitex with an inserted twist level of 195 twists per metre and heat set. However other 1, 2, 3 or 4 ply yarns ranging in count from 1000 to 4500 denier with single filament counts of the order 15 to 100 denier per filament may also be used.

[0033] In this example, the 3 ply cotton/nylon monofilament yarn 12 consists of one ply of nylon monofilament 14 and two plies of cotton 16. The nylon monofilament has a diameter of 0.2mm: however polyester monofilament varying in diameter from 0.025mm to 0.5mm would also be suitable. The two plies of cotton 16 are of count 2's cotton count and are twisted with the monofilament 14. Counts of 10's to 1's cotton count would also be suitable in 1, 2, 3, 4, 5 or 6 ply.

[0034] Blends of cotton and polyester up to 50% would also be suitable. The addition of a low melting point polyester may be advantageous in that the yarn would then be heat set during the pressing process and the polyester would melt into the cotton, giving better abrasion resistance and improved adhesion to the monofilament. It would also be possible to achieve the same effect by melting the nylon monofilament either by heat setting, microwaving or heating by some other suitable means.

[0035] The mat shown in Fig.2 has a fabric layer 22 and a rubber backing 24. The fabric layer 22 includes a tufted pile 26, which is tufted onto a substrate (or primary backing) 28, for example of woven or non-woven polyester or polypropylene of density between 70 and 300 gms/m<sup>2</sup>. In the preferred example we use a non-woven polyester substrate of density 100 gms/m<sup>2</sup>. The pile 26 can be cut, looped or both, and typically consists of cut pile. The fabric layer 22 is bonded to the backing 24 of nitrile rubber in a heated press, for example at a temperature of 170°C and a pressure of 30 pounds per square inch, applied for a cycle time of six minutes.

[0036] The pile 26 is made up of three yarn types, these being:

A: a first yarn 30 of multiple nylon monofilaments,,

and

B: a second yarn 32 of high twist nylon, and

C: a third yarn 34 of cotton or cotton blend.

[0037] The fibre layer 22 is produced by creeling the tufting machine as follows:

A B B C C A B B C C etc.

[0038] This produces a 1:2:2 tufted pile with two tufts (or "ends") of high twist nylon yarn 32 and two tufts or "ends" of cotton or cotton blend for each tuft or end of multiple nylon monofilament yarn 30. Other ratios are of course possible: for example, the tufted pile may include three ends of cotton or cotton blend and two ends of high twist nylon for each end of multiple monofilament yarn.

[0039] In the example described above, the first yarn 30 of multiple monofilament yarn comprises eight filaments of 0.2mm diameter, 420 decitex nylon, single ply twisted and heat set, to produce a yarn with a count of 3360 decitex. The second yarn 32 of high twist nylon comprises 68 filaments of 19.1 decitex, solution-dyed Nylon 6, two ply twisted and heat set to produce a yarn with a count of 1300 decitex. The third yarn 34 of cotton or cotton blend comprises a 7.5s cotton count, 6 fold yarn.

[0040] Various yarns may be used for the cotton or cotton blend yarn 34, preferred examples being as follows:

i. 100% cotton.

ii. A blend of 70% cotton and 30% rayon. The rayon used may be the type sold under the trade mark AMICOR PLUS, which has antimicrobial properties and imparts mildew resistance to the cotton.

iii. A blend of 80% cotton and 20% polyester. The polyester gives added strength to the yarn and improves the wear characteristics of the mat.

iv. A blend of 80% cotton and 20% polypropylene. The polypropylene has antimicrobial properties and a low melting point, which allows it to fuse with the cotton during the heated vulcanisation process, thereby preventing linting and giving improved abrasion resistance.

[0041] Other suitable blends of cotton and synthetic fibres may also be used.

[0042] The combination of regular high twist nylon, thick scratchy nylon monofilaments and cotton or cotton blend gives a balance of cleaning properties, grit retention and water absorption.

# Claims

1. A dust control mat having a tufted fibre layer including a substrate and tufts of a plurality of yarns, including a twisted synthetic yarn, a synthetic monofilament yarn and a yarn that has good moisture absorbing characteristics. 5
2. A mat according to claim 1, wherein the twisted synthetic yarn is a high twist nylon yarn. 10
3. A mat according to claim 1 or claim 2, wherein the twisted synthetic yarn is a two ply twisted and heat set yarn. 15
4. A mat according to anyone of the preceding claims, wherein the twisted synthetic yarn is a yarn of solution-dyed Nylon 6. 15
5. A mat according to any one of the preceding claims, wherein the count of the twisted synthetic yarn is in the range 1000 to 5000 decitex, and is preferably approximately 1300 decitex. 20
6. A mat according to any one of the preceding claims, wherein the synthetic monofilament yarn is a single ply twisted and heat set yarn of multiple nylon, polyester or polypropylene monofilaments. 25
7. A mat according to claim 6, wherein the count of the individual monofilaments in the synthetic monofilament yarn is in the range 8 to 5700 decitex and is preferably approximately 420 decitex. 30
8. A mat according to any one of the preceding claims, wherein the moisture absorbing yarn is a cotton yarn or a cotton blend yarn. 35
9. A mat according to claim 8, wherein the moisture absorbing yarn includes a blend of cotton and rayon, or cotton and polyester, or cotton and polypropylene. 40
10. A mat according to claim 8 or claim 9, wherein the moisture absorbing yarn is a six fold yarn of cotton yarn of cotton count 20 to cotton count 3, preferably cotton count 7.5. 45
11. A mat according to any one of the preceding claims, wherein the ratio of twisted synthetic yarn tufts to synthetic monofilament yarn tufts in the fibre layer is in the range 2:1 to 6:1, preferably 2:1. 50
12. A mat according to any one of the preceding claims, wherein the ratio of moisture absorbing yarn tufts to synthetic monofilament yarn tufts in the fibre layer is in the range 2:1 to 6:1, preferably 3:1. 55
13. A dust control mat having a tufted fibre layer including a substrate and tufts of a first yarn and a second yarn, wherein the first yarn is a twisted synthetic yarn and the second yarn is a twisted yarn that includes a synthetic monofilament and a third yarn having good moisture absorbing characteristics.
14. A mat according to any one of the preceding claims, wherein the substrate includes a layer of non-woven polyester.
15. A mat according to any one of the preceding claims, wherein the tufted fibre layer is bonded to a rubber backing layer.
16. A mat according to any one of the preceding claims, wherein the mat is a washable dust control mat.
17. A washable dust control mat having a tufted fibre layer including tufts of a plurality of yarns and a substrate of non-woven polyester, and a rubber backing layer to which the tufted fibre layer is bonded, the plurality of yarns including a high twist, twisted and heat set synthetic yarn, a twisted and heat set yarn of multiple synthetic monofilaments, and a cotton or cotton blend yarn that has good moisture absorbing characteristics.
18. A process for manufacturing dust control mats, in which a plurality of yarns are tufted onto a substrate to produce a tufted fibre layer having tufts of said yarns, wherein said plurality of yarns include a twisted synthetic yarn, a synthetic monofilament yarn and a yarn that has good moisture absorbing characteristics.
19. A process for manufacturing dust control mats, in which a first yarn and a second yarn are tufted onto a substrate to produce a tufted fibre layer having tufts of said first and second yarns, wherein the first yarn is a twisted synthetic yarn and the second yarn is a twisted yarn that includes a synthetic monofilament and a third yarn having good moisture absorbing characteristics.

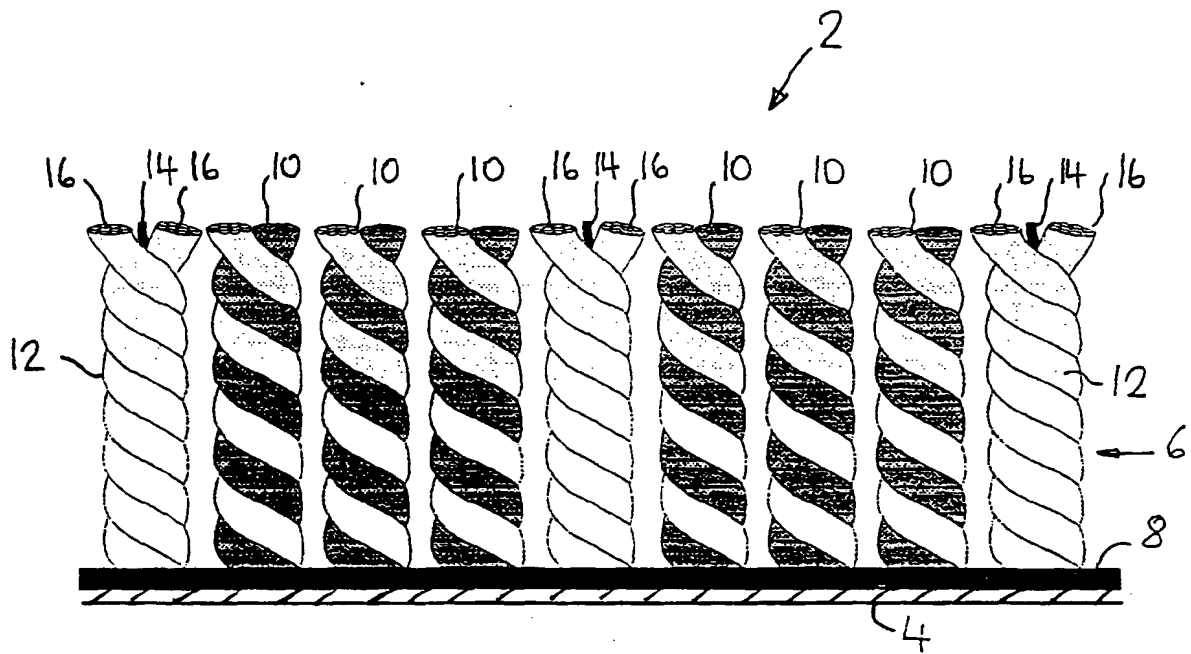
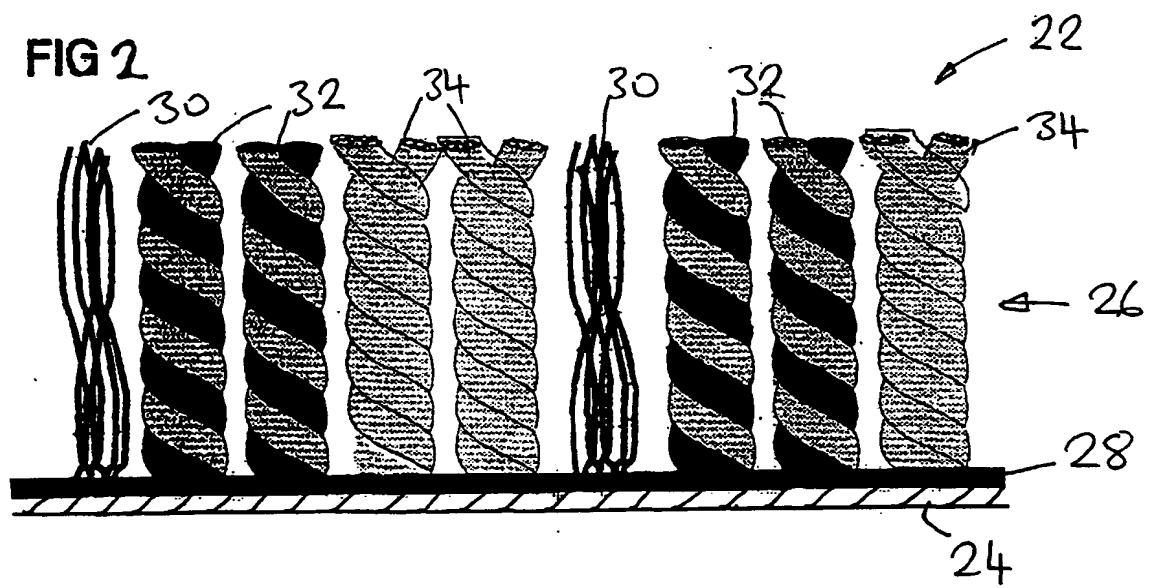


FIG. 1





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# EUROPEAN SEARCH REPORT

Application Number  
EP 99 11 1535

DOCUMENTS CONSIDERED TO BE RELEVANT			
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			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A47L D05C D04H D06N D07F
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 12 October 1999	Examiner Laue, F
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EPO FORM 1503 03.02 (P4/C01)



**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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